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(54)【発明の名称】改善された性質を示す生物分解可能なガムベース

(57)【要約】
本発明は、ガムベース及び少なくとも１つのその他の従来のチューイングガム成分を含むチューイングガムを対象とする。該チューイングガムはガムベースとして、主に生物分解可能な及び／又は加水分解可能なエステル基に基づく少なくとも１つの分岐ポリマーを有する。

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
In the substance described by old [based on the polymer which can be biodegraded], this invention relates to the chewing gum containing the gum base and/or additive which consist of material in which the much more pliability and the ease of biting are shown, and which can be biodegraded. It is publicly known that a chewing gum substance is made from the polymer which can be admitted more that it can biodegrade rather than the polymer which is used as a gum base in the chewing gum, and in which the conventional biodegradation is impossible, and environmentally. What uses aliphatic polyester, for example the example of such things to US-A-5,672,367 and EP-A-0711506. To US-A-6,153,231 which indicated oxazoline or urethane which consists of a poly (lactic acid) copolymer. And what is using the bacterial polyhydroxy alkanoate which has a side chain of C_4 to C_{30} for a chewing gum substance is described by WO-A-99/39588.
[0002]
The further example of the chewing gum containing the gum base which is prepared from aliphatic polyester and which can be biodegraded is indicated to WO-A-00/19837. However, the gum base based on these indicated poly (D, L-lactic acid) and its copolymer needs a plasticizer in order to obtain indispensable pliability and the ease of biting in a gum base. A poly (D, L-lactic acid) pure glass transition temperature with the viscosity average molecular weight of 42200 g/mol is 35.8 **. Since it is publicly known to have a glass transition temperature higher than it as for such a kind of polymer, poly of show [such low softening temperature] with this pure molecular weight with no plasticizer (D, L-lactic acid) is clear.
[0003]
EP-A-0882751 indicates the method for preparing the aliphatic polyester which can be biodegraded under very little cocatalyst existence having contained glycerol or a butyrolactone. The prepared polyester showed dissolution viscosity lower than the polymer prepared without cocatalyst with the desirable molding temperature of about 180 **.
[Description of the Invention]
[0004]
However, it prepares by making polymer of branching which has some polyester branching or the arm which has added the gum base to the central polyfunctional compound in this invention, or a star shape. Then, the gum base which has pliability and the ease of biting outstanding by the surprising thing is obtained as a result. There is the further unobviousness of this invention in having used the specific start compound or the preparation conditions of giving the character to function on a final chewing gum additionally.
[0005]
this invention is a thing about the gum base which can be biodegraded -- the special character -- selection of a start compound -- and/or, it is related with what is obtained by the preparation conditions

between polymer synthesis or between polymerization post-processing.
[0006]
this invention **** -- the polymer used is branched polymer which has polyester branching or the arm of shoes which wants to polymerize in the polyfunctional compound accompanied by desired character. It is expressed with formula (I) of the following in outline. :
[0007]
[Formula 1]

$$\text{©}-[\text{ポリマーアーム}]_n \qquad \text{(I)}$$

[0008]
C is a main polyfunctional basis among a formula, and n is the polymer arm added to C.
[0009]
Polymer by this invention L,L-lactide, D,D-lactide, rac-lactide, It is prepared from the ring compound in which others like lactone, such as cyclic ester, such as ****- lactide or its mixture, glycolide, and trimethylene carbo NETO, beta propiolactone, delta-valerolactone, and epsilon-caprolactone, or cyclic amide correspond. Polymer is prepared again also by the condensation reaction of the monomeric unit of lactic acid, glycolic acid, hydroxy acid like amino acid or diol, and diacid, and it deals in it. Such polymer can be used with the gestalt of the mixture of block copolymer, a random copolymer, a graft copolymer or two ****- or more, and/or a copolymer. The concept that the start compound in a polymerization affects many different character more can explain this invention. Some of those different character is shown below. :
[0010]
1. An initiator is reflected in the structure of polymer, i.e., the viscoelasticity of a gum base, and it determines the grade of branching of deciding the chewing character of a chewing gum similarly (the examples of such a compound are decanol, a pentaerythritol, and a dipentaerythritol).
[0011]
2. The kind of start ingredient used can affect other character concerning appearance as the performance of a chewing gum. As an example of such character, the sweet taste effect, conformity with other raw materials, and clever retention are mentioned (the examples of such a compound are decanol, sorbitol, and inositol).
[0012]
3. Selection of processing after a start ingredient and/or preparation conditions, or a polymerization, For example, the advantage from the standpoint of a healthy side may be provided by giving an antibacterial effect (lactic acid and lactone are publicly known antimicrobial) or other effects (as an example of such a compound, they are lactone, xylitol, organic acid, a hydroxyl apatite, etc.) to a gum base.
[0013]
4. A start ingredient, a preparing method, and processing conditions have the serious influence for the hydrolysis stability of the polymer used for a gum base. And that makes it possible to influence the component stereo stability and to remove the chewing gum which is not needed, for example from clothes, furniture, a road, and a floor. A decomposition promotion compound may be a compound (for example, amino ****** is an amide compound) which carries out the catalyst of the compound (for example, an anhydride or a carboxylic acid compound) or hydrolysis rate to which hydrophilic nature is made to increase.
[0014]
The polyfunctional compound by this invention usually contains three or the hydroxyls beyond it, such as trimethylolethane, trimethylolpropane, butanetriol, a phloroglucinol, an erythritol, a pentaerythritol, or a dipentaerythritol. It is arbitrary and the polyfunctional compound produced by the nature of 1 sugar, such as hexose, pentose or maltitol, sorbitol, mannitol, xylitol, and inositol, a disaccharide, or the sugar of trisaccharide may be used. A polyfunctional compound may be used independently or it may use in

other monofunctional nature or polyfunctional compounds, and what kind of combination. However, he should understand that this invention should be considered by the broader meaning in the pneuma and the range of this invention rather than should be limited to the polyfunctional compound of shoes to be mentioned as an example here. It is clear that what a polyfunctional compound does not necessarily need to be compound containing hydroxyl groups, and consists of others, for example, a start kind like an amino group, for example may be used for a person skilled in the art.

[0015]

. In the desirable embodiment of this invention, are accompanied by at least one polymer containing lactide. One or more cyclic ester, such as lactide and glycolide, trimethylene carbonate, The star shape copolymer or block copolymer of a mixture of lactone, such as beta propiolactone, delta-valerolactone, epsilon-caprolactone or lactone of bigger size, or two polymer or more is used in a gum base. Preferably, the system containing at least 50-mol% of lactide which contains at least 65-mol% of lactide more preferably is used.

[0016]

Any conventional polymerization art like the polymerization in the bulk performed while a proper quantity of suitable polymerization catalysts generally exist for example, or a solution can perform a polymerization.

[0017]

A chewing gum usually consists of a water-soluble bulk section, a nonaqueous solubility gum base, and a seasoning ingredient. The water-soluble portion of a chewing gum includes a plasticizer, sweetners, and those combination, for example. Glycerin, lecithin, and the plasticizer like the combination were added in order to raise the softness and the ease of biting of a nonaqueous solubility gum base conventionally. However, it turned out that it is not required in order that use of a plasticizer may acquire the ease of biting and taste required for a chewing gum to a surprising thing in this invention. A plasticizer may be arbitrarily used for the gum base substance indicated in this specification.

[0018]

Water-soluble sweetners is constituted by independent or other sweetners, such as sugars, dry invert sugar, sucrose, dextrose, maltose, fructose, levulose, galactose, etc. containing the ingredient currently conventionally used for the chewing gum, for example, and combination. For example, the sugarless sweetners containing sugar-alcohol, such as sorbitol, mannitol, xylitol, maltitol, and hydrogenation starch hydrolyzate, is also generally used combining independent or other sweetners. It is independent, or other typical sweetners, for example, Aspartame, Acesulfam, and the thing like sugars may be combined and used.

[0019]

A chewing gum may contain further about 0.1 to 10% of seasoning ingredient. The seasoning ingredient may contain vegetation, such as a SHITORASU oil, a fruit extract, peppermint oil, spearmint oil, clove oil, and anise oil, and the oil from fruits combining other tastes containing independent or an effector, for example.

[0020]

It is arbitrary to a chewing gum and bulking agents, such as magnesium carbonate and calcium carbonate, kaolin, tricalcium phosphate, talc, woody fiber, apple textiles, zein, gluten, and casein, may be added to it. A desirable natural organic bulking agent is used in this invention.

[0021]

Additional ingredients, such as colorant, medicinal components, a modifier in a mouth, and an antioxidant, may also be added to a chewing gum the midst of a polymerization, or after that.

[0022]

Although limitation is not necessarily given to this invention, an example is given to below for explanation. The standard experiment procedure was used in all the chemical handlings, preparation, desiccation, and composition. In order to acquire polymer of specific number average molar mass, and/or a copolymer presentation, the publicly known numerical orientation method was used in this industry. When there was no other description, the polymerization experiment was conducted under the

inert atmosphere by the Brabender W50E mixer heated electrically. The usual polymerization conditions are as follows. :
- Polymerization temperature : 140-170 **
- Polymerization time : 30 to 240 minutes
- Revolving speed of a mixer : 15 rpm
- 0.05% of the weight of 2-ethylhexanoic acid tin was used as a catalyst.
- The quantity of a monomer and an initiator changes with copolymer presentations of the polymer obtained as the calculated number average molar mass and/or a result, and make it the total quantity in a mixer set to 40 g.

[0023]
The GPC (gel permeation chromatography) device was used for molar mass measurement. Monomer conversion, number average molar mass, and a copolymer presentation were determined with NMR method. In order to measure the quality of pyrogenicity, for example, glass transition temperature, (T_g), the differential scanning calorimetry (DSC) was used.

[0024]
Although this invention is described in detail using a concrete desirable embodiment, even if it is correction and modification of a desirable gestalt which a person skilled in the art invents immediately in reading and understanding an above-mentioned thing, being contained in the pneuma and the range of a claim of this invention should be understood enough.

[Example]

[0025]
Example 1
(50/50) It prepared by carrying out ring opening polymerization of the formless amorphous copolymer of rac **RAKUCHIDO in a melted object using a different hydroxyl compound as an initiator. An initiator and some polymer character are put on Table 1.

[0026]
[Table 1]

rac-ラクチドに基づくガムベースの調製における、異なる開始剤の例

実験番号	開始剤	Mw(g/mol)	Mn(g/mol)	Tg (℃)
1	1－デカノール	33500	20000	44
2	フロログルシノール	33800	19900	49
3	イノシトール	16400	12600	44
4	ジペンタエリトリトール	21600	18300	43

[0027]
Example 2
It prepared by using the star shape copolymer of lactide and epsilon-caprolactone with a pentaerythritol core by using poly (epsilon-caprolactone) of a star shape as a macro initiator, and carrying out ring opening polymerization in a melted object. as [resembled / the gum base of the star shape polymer which does not add other ingredients / a kind of the chewing gum of the conventional marketing] -- it bit and the feeling was shown. The result of an experiment Nakajo affair and its series is shown in Table 2.

[0028]
[Table 2]

ラクチド及びε－カプロラクトンの分岐コポリマーから成るガムベースの例

実験番号	ラクチド	ε-CL/ラクチド比	Mw(g/mol)	Mn(g/mol)	Tg (℃)
5	Rac	37/63	29600	25900	-20
6	L,L	42/58	26400	23900	-*)
7	Rac	54/46	19300	17200**)	-23
8	Rac	32/68	43700	32600**)	-13
9	Rac	22/78	67500	43000**)	+2

*) 検出されず；DSCよりT_m＝１５０℃、ΔH＝３３J/g

**) NMRによる

[0029]
Example 3
The star shape random copolymer which comprises epsilon-caprolactone and (50/50) rac-lactide was prepared by the ring opening polymerization started by the pentaerythritol in a melted object. The character of polymer is shown in Table 3.
[0030]
[Table 3]

racーラクチド及びε－カプロラクトンの分岐ランダムコポリマーからなるガムベースの例

実験番号	ε-CL/ラクチド比	Mn(g/mol)*)	Mw/Mn	Tg (℃)
10	3/97	17500	1.34	+45
11	8/92	16700	1.35	+40
12	14/86	15800	1.42	+35

*) NMRによる

[0031]
Example 4
800 g of 88%L-lactide is dried, and in the standard experiment rotation evaporator under existence of 0.2-% of the weight tin(II) oxide and the situation of calling it decompression and an argon style at 180 **, the condensation polymerization was carried out until poly (L-lactic acid) Mn became 1900 g/mol (Mw/Mn=3.12). It was made to combine with 96 g of star shape poly (epsilon-caprolactone) which has the hydroxyl accompanied by [it was accompanied by poly (L-lactic acid) with the experiment rotation evaporator, and] a pentaerythritol core at 195 ** (p=5mbar) in an end further from it. As a result, the star shape copolymer of Mn=7400 g/mol was obtained. DSC showed Tg=-22 ** and Tm=130 **.
[0032]
Example 5
800 g of 88% L-lactic acid is dried, and under existence of 20g succinic acid and 0.1-% of the weight 2-ethylhexanoic acid tin and in the standard experiment rotation evaporator decompressed at 180 **, the condensation polymerization was carried out until poly (L-lactic acid) Mw became 3800 g/mol (Mw/Mn=3.12). 40 g of star shape poly (epsilon-caprolactone) which has the hydroxyl accompanied by [it was accompanied by 40 g of unstable poly (L-lactic acid) with the experiment rotation evaporator,

and] a pentaerythritol core at 180 ** (p=25mbar) in an end further, It was made to join together until the soft star shape multi-branching copolymer of Mw=40600 g/mol was obtained as a result.

[0033]

Example 6

88%D and L-lactic acid are dried, and under existence of 0.1-% of the weight 2-ethylhexanoic acid tin and in the standard experiment rotation evaporator decompressed at 180 **, the condensation polymerization was carried out until poly (D, L-lactic acid) Mw became in 3000g (Mw/Mn=2.70)/mol. unstable poly (D, L-lactic acid) -- and it was made to polymerize with 117.0 g of star shape poly (epsilon-caprolactone) which has the hydroxyl accompanied by a pentaerythritol core in an end at 180 ** (p=23mbar) with an experiment rotation evaporator further As a result, the star shape copolymer of Mw=8500 g/mol was obtained. Although any plasticizers were not added, when this soft copolymer was measured by DSC, it showed 6 ** Tg.

[0034]

Example 7

The star shape random copolymer which comprises epsilon-caprolactone and (50/50) rac-lactide was prepared by the ring opening polymerization started by the pentaerythritol in a melted object. It is decided by selection of polymerization time that the quantity of available residue lactide (it becomes lactic acid eventually) will be hydrolysis (Table 4).

[0035]

[Table 4]

縮合時間の関数としての残渣ラクチドの量

実験番号*)	異なる重合時間による残渣ラクチド(mol%)**)		
	30分	60分	90分
10	7	5.6	3.6
11	10.7	3.9	2.7
12	4.3	2.4	1.8

*) 実施例３による実験番号；**) NMRにより

[0036]

Example 8

The star shape copolymer of rac-lactide and epsilon-caprolactone was prepared by the same method as Example 2, and the rheology character of the gum base was investigated. The gum base which does not add other ingredients showed the rheology character which is equal to the conventional gum base.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention]
[0001]
In the substance described by old [based on the polymer which can be biodegraded], this invention relates to the chewing gum containing the gum base and/or additive which consist of material in which the much more pliability and the ease of biting are shown, and which can be biodegraded. It is publicly known that a chewing gum substance is made from the polymer which can be admitted more that it can biodegrade rather than the polymer which is used as a gum base in the chewing gum, and in which the conventional biodegradation is impossible, and environmentally. What uses aliphatic polyester, for example the example of such things to US-A-5,672,367 and EP-A-0711506. To US-A-6,153,231 which indicated oxazoline or urethane which consists of a poly (lactic acid) copolymer. And what is using the bacterial polyhydroxy alkanoate which has a side chain of C_4 to C_{30} for a chewing gum substance is described by WO-A-99/39588.
[0002]
The further example of the chewing gum containing the gum base which is prepared from aliphatic polyester and which can be biodegraded is indicated to WO-A-00/19837. However, the gum base based on these indicated poly (D, L-lactic acid) and its copolymer needs a plasticizer in order to obtain indispensable pliability and the ease of biting in a gum base. A poly (D, L-lactic acid) pure glass transition temperature with the viscosity average molecular weight of 42200 g/mol is 35.8 **. Since it is publicly known to have a glass transition temperature higher than it as for such a kind of polymer, poly of show [such low softening temperature] with this pure molecular weight with no plasticizer (D, L-lactic acid) is clear.
[0003]
EP-A-0882751 indicates the method for preparing the aliphatic polyester which can be biodegraded under very little cocatalyst existence having contained glycerol or a butyrolactone. The prepared polyester showed dissolution viscosity lower than the polymer prepared without cocatalyst with the desirable molding temperature of about 180 **.
[Description of the Invention]
[0004]
However, it prepares by making polymer of branching which has some polyester branching or the arm which has added the gum base to the central polyfunctional compound in this invention, or a star shape. Then, the gum base which has pliability and the ease of biting outstanding by the surprising thing is obtained as a result. There is the further unobviousness of this invention in having used the specific start compound or the preparation conditions of giving the character to function on a final chewing gum additionally.
[0005]
this invention is a thing about the gum base which can be biodegraded -- the special character -- selection of a start compound -- and/or, it is related with what is obtained by the preparation conditions between polymer synthesis or between polymerization post-processing.

[0006]
this invention **** -- the polymer used is branched polymer which has polyester branching or the arm of shoes which wants to polymerize in the polyfunctional compound accompanied by desired character. It is expressed with formula (I) of the following in outline. :
[0007]
[Formula 1]

$$©-[\text{ポリマーアーム}]_n \qquad (I)$$

[0008]
C is a main polyfunctional basis among a formula, and n is the polymer arm added to C.
[0009]
Polymer by this invention L,L-lactide, D,D-lactide, rac-lactide, It is prepared from the ring compound in which others like lactone, such as cyclic ester, such as ****- lactide or its mixture, glycolide, and trimethylene carbo NETO, beta propiolactone, delta-valerolactone, and epsilon-caprolactone, or cyclic amide correspond. Polymer is prepared again also by the condensation reaction of the monomeric unit of lactic acid, glycolic acid, hydroxy acid like amino acid or diol, and diacid, and it deals in it. Such polymer can be used with the gestalt of the mixture of block copolymer, a random copolymer, a graft copolymer or two ****- or more, and/or a copolymer. The concept that the start compound in a polymerization affects many different character more can explain this invention. Some of those different character is shown below. :
[0010]
1. An initiator is reflected in the structure of polymer, i.e., the viscoelasticity of a gum base, and it determines the grade of branching of deciding the chewing character of a chewing gum similarly (the examples of such a compound are decanol, a pentaerythritol, and a dipentaerythritol).
[0011]
2. The kind of start ingredient used can affect other character concerning appearance as the performance of a chewing gum. As an example of such character, the sweet taste effect, conformity with other raw materials, and clever retention are mentioned (the examples of such a compound are decanol, sorbitol, and inositol).
[0012]
3. Selection of processing after a start ingredient and/or preparation conditions, or a polymerization, For example, the advantage from the standpoint of a healthy side may be provided by giving an antibacterial effect (lactic acid and lactone are publicly known antimicrobial) or other effects (as an example of such a compound, they are lactone, xylitol, organic acid, a hydroxyl apatite, etc.) to a gum base.
[0013]
4. A start ingredient, a preparing method, and processing conditions have the serious influence for the hydrolysis stability of the polymer used for a gum base. And that makes it possible to influence the component stereo stability and to remove the chewing gum which is not needed, for example from clothes, furniture, a road, and a floor. A decomposition promotion compound may be a compound (for example, amino ****** is an amide compound) which carries out the catalyst of the compound (for example, an anhydride or a carboxylic acid compound) or hydrolysis rate to which hydrophilic nature is made to increase.
[0014]
The polyfunctional compound by this invention usually contains three or the hydroxyls beyond it, such as trimethylolethane, trimethylolpropane, butanetriol, a phloroglucinol, an erythritol, a pentaerythritol, or a dipentaerythritol. It is arbitrary and the polyfunctional compound produced by the nature of 1 sugar, such as hexose, pentose or maltitol, sorbitol, mannitol, xylitol, and inositol, a disaccharide, or the sugar of trisaccharide may be used. A polyfunctional compound may be used independently or it may use in other monofunctional nature or polyfunctional compounds, and what kind of combination. However, he

should understand that this invention should be considered by the broader meaning in the pneuma and the range of this invention rather than should be limited to the polyfunctional compound of shoes to be mentioned as an example here. It is clear that what a polyfunctional compound does not necessarily need to be compound containing hydroxyl groups, and consists of others, for example, a start kind like an amino group, for example may be used for a person skilled in the art.

[0015]

. In the desirable embodiment of this invention, are accompanied by at least one polymer containing lactide. One or more cyclic ester, such as lactide and glycolide, trimethylene carbonate, The star shape copolymer or block copolymer of a mixture of lactone, such as beta propiolactone, delta-valerolactone, epsilon-caprolactone or lactone of bigger size, or two polymer or more is used in a gum base. Preferably, the system containing at least 50-mol% of lactide which contains at least 65-mol% of lactide more preferably is used.

[0016]

Any conventional polymerization art like a polymerization in bulk performed while a proper quantity of suitable polymerization catalysts generally exist for example, or a solution can perform a polymerization.

[0017]

A chewing gum usually consists of a water-soluble bulk section, a nonaqueous solubility gum base, and a seasoning ingredient. A water-soluble portion of a chewing gum includes a plasticizer, sweetners, and those combination, for example. Glycerin, lecithin, and a plasticizer like the combination were added in order to raise softness and the ease of biting of a nonaqueous solubility gum base conventionally. However, it turned out that it is not required in order that use of a plasticizer may acquire the ease of biting and taste required for a chewing gum to a surprising thing in this invention. A plasticizer may be arbitrarily used for a gum base substance indicated in this specification.

[0018]

Water-soluble sweetners is constituted by independent or other sweetners, such as sugars, dry invert sugar, sucrose, dextrose, maltose, fructose, levulose, galactose, etc. containing an ingredient currently conventionally used for a chewing gum, for example, and combination. For example, sugarless sweetners containing sugar-alcohol, such as sorbitol, mannitol, xylitol, maltitol, and hydrogenation starch hydrolyzate, is also generally used combining independent or other sweetners. It is independent, or other typical sweetners, for example, Aspartame, Acesulfam, and a thing like sugars may be combined and used.

[0019]

A chewing gum may contain further about 0.1 to 10% of seasoning ingredient. The seasoning ingredient may contain vegetation, such as a SHITORASU oil, a fruit extract, peppermint oil, spearmint oil, clove oil, and anise oil, and the oil from fruits combining other tastes containing independent or an effector, for example.

[0020]

It is arbitrary to a chewing gum and bulking agents, such as magnesium carbonate and calcium carbonate, kaolin, tricalcium phosphate, talc, woody fiber, apple textiles, zein, gluten, and casein, may be added to it. A desirable natural organic bulking agent is used in this invention.

[0021]

Additional ingredients, such as colorant, medicinal components, a modifier in a mouth, and an antioxidant, may also be added to a chewing gum the midst of a polymerization, or after that.

[0022]

Although limitation is not necessarily given to this invention, an example is given to below for explanation. The standard experiment procedure was used in all the chemical handlings, preparation, desiccation, and composition. In order to acquire polymer of specific number average molar mass, and/or a copolymer presentation, the publicly known numerical orientation method was used in this industry. When there was no other description, the polymerization experiment was conducted under the inert atmosphere by the Brabender W50E mixer heated electrically. The usual polymerization conditions

are as follows. :
- Polymerization temperature : 140-170 **
- Polymerization time : 30 to 240 minutes
- Revolving speed of a mixer : 15 rpm
- 0.05% of the weight of 2-ethylhexanoic acid tin was used as a catalyst.
- The quantity of a monomer and an initiator changes with copolymer presentations of the polymer obtained as the calculated number average molar mass and/or a result, and make it the total quantity in a mixer set to 40 g.

[0023]
The GPC (gel permeation chromatography) device was used for molar mass measurement. Monomer conversion, number average molar mass, and a copolymer presentation were determined with NMR method. In order to measure the quality of pyrogenicity, for example, glass transition temperature, (T_g), the differential scanning calorimetry (DSC) was used.

[0024]
Although this invention is described in detail using a concrete desirable embodiment, even if it is correction and modification of a desirable gestalt which a person skilled in the art invents immediately in reading and understanding an above-mentioned thing, being contained in the pneuma and the range of a claim of this invention should be understood enough.

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EXAMPLE

[Example]
[0025]
Example 1
(50/50) It prepared by carrying out ring opening polymerization of the formless amorphous copolymer of rac **RAKUCHIDO in a melted object using a different hydroxyl compound as an initiator. An initiator and some polymer character are put on Table 1.
[0026]
[Table 1]

rac-ラクチドに基づくガムベースの調製における、異なる開始剤の例

実験番号	開始剤	Mw(g/mol)	Mn(g/mol)	Tg (℃)
1	1－デカノール	33500	20000	44
2	フロログルシノール	33800	19900	49
3	イノシトール	16400	12600	44
4	ジペンタエリトリトール	21600	18300	43

[0027]
Example 2
It prepared by using the star shape copolymer of lactide and epsilon-caprolactone with a pentaerythritol core by using poly (epsilon-caprolactone) of a star shape as a macro initiator, and carrying out ring opening polymerization in a melted object. as [resembled / the gum base of the star shape polymer which does not add other ingredients / a kind of the chewing gum of the conventional marketing] -- it bit and the feeling was shown. The result of an experiment Nakajo affair and its series is shown in Table 2.
[0028]
[Table 2]

ラクチド及びε－カプロラクトンの分岐コポリマーから成るガムベースの例

実験番号	ラクチド	ε-CL/ラクチド比	Mw(g/mol)	Mn(g/mol)	Tg (℃)
5	Rac	37/63	29600	25900	-20
6	L,L	42/58	26400	23900	-*)
7	Rac	54/46	19300	17200**)	-23
8	Rac	32/68	43700	32600**)	-13
9	Rac	22/78	67500	43000**)	+2

*) 検出されず；DSCよりT_m＝１５０℃、ΔH＝３３J/g

**) NMRによる

[0029]
Example 3
The star shape random copolymer which comprises epsilon-caprolactone and (50/50) rac-lactide was prepared by the ring opening polymerization started by the pentaerythritol in a melted object. The character of polymer is shown in Table 3.
[0030]
[Table 3]

racーラクチド及びε－カプロラクトンの分岐ランダムコポリマーからなるガムベースの例

実験番号	ε-CL/ラクチド比	Mn(g/mol)*)	Mw/Mn	Tg (℃)
10	3/97	17500	1.34	+45
11	8/92	16700	1.35	+40
12	14/86	15800	1.42	+35

*) NMRによる

[0031]
Example 4
800 g of 88%L-lactide is dried, and in the standard experiment rotation evaporator under existence of 0.2-% of the weight tin(II) oxide and the situation of calling it decompression and an argon style at 180 **, the condensation polymerization was carried out until poly (L-lactic acid) Mn became 1900 g/mol (Mw/Mn=3.12). It was made to combine with 96 g of star shape poly (epsilon-caprolactone) which has the hydroxyl accompanied by [it was accompanied by poly (L-lactic acid) with the experiment rotation evaporator, and] a pentaerythritol core at 195 ** (p=5mbar) in an end further from it. As a result, the star shape copolymer of Mn=7400 g/mol was obtained. DSC showed Tg=-22 ** and Tm=130 **.
[0032]
Example 5
800 g of 88% L-lactic acid is dried, and under existence of 20g succinic acid and 0.1-% of the weight 2-ethylhexanoic acid tin and in the standard experiment rotation evaporator decompressed at 180 **, the condensation polymerization was carried out until poly (L-lactic acid) Mw became 3800 g/mol (Mw/Mn=3.12). 40 g of star shape poly (epsilon-caprolactone) which has the hydroxyl accompanied by [it was accompanied by 40 g of unstable poly (L-lactic acid) with the experiment rotation evaporator,

and] a pentaerythritol core at 180 ** (p=25mbar) in an end further, It was made to join together until the soft star shape multi-branching copolymer of Mw=40600 g/mol was obtained as a result.
[0033]
Example 6
88%D and L-lactic acid are dried, and under existence of 0.1-% of the weight 2-ethylhexanoic acid tin and in the standard experiment rotation evaporator decompressed at 180 **, the condensation polymerization was carried out until poly (D, L-lactic acid) Mw became in 3000g (Mw/Mn=2.70)/mol. unstable poly (D, L-lactic acid) -- and it was made to polymerize with 117.0 g of star shape poly (epsilon-caprolactone) which has the hydroxyl accompanied by a pentaerythritol core in an end at 180 ** (p=23mbar) with an experiment rotation evaporator further As a result, the star shape copolymer of Mw=8500 g/mol was obtained. Although any plasticizers were not added, when this soft copolymer was measured by DSC, it showed 6 ** Tg.
[0034]
Example 7
The star shape random copolymer which comprises epsilon-caprolactone and (50/50) rac-lactide was prepared by the ring opening polymerization started by the pentaerythritol in a melted object. It is decided by selection of polymerization time that the quantity of available residue lactide (it becomes lactic acid eventually) will be hydrolysis (Table 4).
[0035]
[Table 4]

縮合時間の関数としての残渣ラクチドの量

実験番号*)	異なる重合時間による残渣ラクチド(mol%)**)		
	30分	60分	90分
10	7	5.6	3.6
11	10.7	3.9	2.7
12	4.3	2.4	1.8

*) 実施例3による実験番号；**) NMRにより

[0036]
Example 8
The star shape copolymer of rac-lactide and epsilon-caprolactone was prepared by the same method as Example 2, and the rheology character of the gum base was investigated. The gum base which does not add other ingredients showed the rheology character which is equal to the conventional gum base.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
A chewing gum which is a chewing gum containing a gum base and the conventional chewing gum ingredient of at least one others, and contains at least one branched polymer based on an ester group which can mainly be biodegraded as a gum base and/or can be hydrolyzed.
[Claim 2]
A chewing gum which is a chewing gum containing a gum base and at least one chewing gum additive, and contains at least one branched polymer based on an ester group which can mainly be biodegraded as a chewing gum additive, and/or can be hydrolyzed.
[Claim 3]
The chewing gum containing polymer which can biodegrade a star shape which has some branching or an arm added to a central polyfunctional compound as at least one above-mentioned branched polymer according to claim 1 or 2.
[Claim 4]
The chewing gum according to claim 3 based on one or a compound beyond it in which an above-mentioned polyfunctional compound has at least three hydroxyls or an amino group.
[Claim 5]
at least one above-mentioned branched polymer -- ring opening polymerization -- cyclic ester beyond one or it (for example, L,L-lactide.) The chewing gum according to claim 1 based on annular carbo NETO (for example, trimethylene carbo NETO), such as a ring of size of D,D-lactide, rac-lactide, ****-lactide, epsilon-caprolactone, glycolide, or others, and cyclic amide (for example, caprolactam).
[Claim 6]
The chewing gum according to claim 5 in which at least one above-mentioned branched polymer is built with lactic acid and hydroxy acid like glycolic acid from amino acid by polycondensation from one, or the above diol / diacid combination.
[Claim 7]
A start ingredient is the chewing gum compound according to claim 1 like softening temperature, viscoelasticity, a taste, compatibility, or resolvability which crawls on one again and gives a function of shoes to the last substance.
[Claim 8]
Processing conditions are the chewing gum compound according to claim 1 like softening temperature, viscoelasticity, a taste, compatibility, or resolvability which crawls on one again and gives a function of shoes to the last substance.

[Translation done.]